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(54) DATA TRANSMITTING DEVICE AND METHOD THEREFOR

(57)Abstract:

PROBLEM TO BE SOLVED: To shorten a data transfer time when loss is generated, without reducing communication band by multiplexing only a specific communication packet whose large delay is generated, when loss is generated.

SOLUTION: A multiplexing determining part 121 receives transmission data 140 by a communication protocol processing part 10, and determines whether the transmission data 140 should be multiplexed. When it is determined that the transmission data should be multiplexed by the multiplexing determining part 121, a multiplexed packet transmitting part 122 duplicates the packet by a packet duplication processing 125, calls a multiplexed packet transmission processing 126, and passes the packet of the transmission data 140 and the packet of transmission data 160, to an LAN driver 13,

and the LAN driver transmits the multiplexed packet.

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CLAIMS

[Claim(s)]

[Claim 1] The data source characterized by having the following elements.

(a) The transmit data selection section for a duplicate which chooses from two or more transmit data the transmit data set as the object of the duplicate of data as transmit data for a duplicate, (b) The duplicate data generation section which generates the duplicate data which are the duplicate of said transmit data for a duplicate chosen by said transmit data selection section for a duplicate, (c) The transmitting section which transmits said transmit data for a duplicate, and said duplicate data of said transmit data for a duplicate when said duplicate data of said transmit data for a duplicate are generated by said duplicate data generation section.

[Claim 2] The send sequence number which shows each transmitting sequence of two or more of said transmit data is set to each of two or more of said transmit data. Said data source It has the send-sequence-number Records Department

which records the send sequence number which shows the last of transmitting sequence among said send sequence numbers. Furthermore, said transmit data selection section for a duplicate Said send sequence number set as each of two or more of said transmit data It makes into the selection condition of said transmit data for a duplicate to be the send sequence number which shows the transmitting sequence before the send sequence number which shows the last of said transmitting sequence recorded on said send-sequence-number Records Department. The send sequence number which shows the last of said transmitting sequence recorded on said send-sequence-number Records Department, Said send sequence number set as each of two or more of said transmit data is compared. The data source according to claim 1 characterized by using as said transmit data for a duplicate the transmit data judged that the send sequence number which shows the transmitting sequence before the send sequence number which shows the last of said transmitting sequence is set up.

[Claim 3] Each of two or more of said transmit data has a header and data division. Said transmit data selection section for a duplicate It makes for the data size of said data division of each of said two or more transmit data to be zero into the selection condition of said transmit data for a duplicate. The data source

according to claim 1 characterized by using as said transmit data for a duplicate the transmit data with which the data size of said data division was judged, and the data size of said data division was judged to be zero about each of two or more of said transmit data.

[Claim 4] Said transmit data selection section for a duplicate is the data source according to claim 1 characterized by to use as said transmit data for a duplicate the transmit data which made it the selection condition of said transmit data for a duplicate for each of two or more of said transmit data to be the last division data of the division data which divided other transmit data into plurality, judged whether it was said last division data about each of two or more of said transmit data, and was judged to be said last division data.

[Claim 5] Said data source has the data size reference-value Records Department which records further the data size reference value which is a reference value about the data size of transmit data. Said transmit data selection section for a duplicate each data size of two or more of said transmit data It makes into the selection condition of said transmit data for a duplicate to be below the data size reference value recorded on said data size reference-value Records Department. Said data size reference value and data size of two or

more of said transmit data which were recorded on said data size reference-value Records Department are compared. The data source according to claim 1 characterized by using as said transmit data for a duplicate the transmit data judged to be the data size below said data size reference value.

[Claim 6] According to the importance of data, the priority is set to each of two or more of said transmit data. Said data source It has the priority reference-value Records Department which records the priority reference value which is a reference value about said priority. Furthermore, said transmit data selection section for a duplicate Said priority reference value recorded on said priority reference-value Records Department and said priority set as each of two or more of said transmit data are measured. The data source according to claim 1 characterized by using as said transmit data for a duplicate the transmit data judged that the priority beyond said priority reference value is set up.

[Claim 7] According to the importance of data, the priority is set to each of two or more of said transmit data. Said data source It has the priority reference-value Records Department which records the priority reference value which is a reference value about said priority. Furthermore, said transmit data selection section for a duplicate Even if it is the transmit data which measures said priority

reference value recorded on said priority reference-value Records Department, and said priority set as each of two or more of said transmit data, and agrees in said selection condition The transmit data judged that the priority below said priority reference value is set up is the data source according to claim 2 to 5 characterized by not considering as said transmit data for a duplicate.

[Claim 8] Said transmitting section resends said transmit data for a duplicate and said duplicate data. Said data source With furthermore, the retry count Records Department which records the retry count of said transmit data for a duplicate based on said transmitting section, and said duplicate data With the retry count reference-value Records Department which records the retry count reference value which is a reference value about said retry count The retry count comparator which compares said retry count recorded on said retry count Records Department with said retry count reference value recorded on said retry count reference-value Records Department, It has the number Records Department of duplicate data duplicates which records the number of duplicates of said duplicate data which said duplicate data generation section generates to the same transmit data for a duplicate. Said retry count comparator Said retry count recorded on said retry count Records Department is compared with said

retry count reference value recorded on said retry count reference-value Records Department. When it is judged that said retry count is said beyond retry count reference value, the increment directions in the number of duplicates which direct the increment in said number of duplicates to said number Records Department of duplicate data duplicates are outputted. Said number Records Department of duplicate data duplicates increases said number of duplicates according to said increment directions in the number of duplicates outputted from said retry count comparator. Said duplicate data generation section The data source according to claim 1 characterized by generating said duplicate data according to said number of duplicates recorded on said number Records Department of duplicate data duplicates.

[Claim 9] It is the data source according to claim 1 which said data source has further the transmitting spacing setting-out section which sets up transmitting spacing of transmission of said transmit data for a duplicate based on said transmitting section, and said duplicate data, and is characterized by said transmitting section transmitting said transmit data for a duplicate and said duplicate data according to said transmitting spacing set up by said transmitting spacing setting-out section.

[Claim 10] The data transmitting approach characterized by having the following elements.

(a) The transmit data selection step for a duplicate which chooses from two or more transmit data the transmit data set as the object of the duplicate of data as transmit data for a duplicate, (b) The duplicate data generation step which generates the duplicate data which are the duplicate of said transmit data for a duplicate chosen by said transmit data selection step for a duplicate, (c) Transmitting step which transmits said transmit data for a duplicate, and said duplicate data of said transmit data for a duplicate when said duplicate data of said transmit data for a duplicate are generated by said duplicate data generation step.

[Claim 11] The send sequence number which shows each transmitting sequence of two or more of said transmit data is set to each of two or more of said transmit data. Said data transmitting approach It has the send-sequence-number record step which records the send sequence number which shows the last of transmitting sequence among said send sequence numbers. Furthermore, said transmit data selection step for a duplicate Said send sequence number set as each of two or more of said transmit data It makes into the selection condition of

said transmit data for a duplicate to be the send sequence number which shows the transmitting sequence before the send sequence number which shows the last of said transmitting sequence recorded on said send-sequence-number record step. The send sequence number which shows the last of said transmitting sequence recorded on said send-sequence-number record step, Said send sequence number set as each of two or more of said transmit data is compared. The data transmitting approach according to claim 10 characterized by using as said transmit data for a duplicate the transmit data judged that the send sequence number which shows the transmitting sequence before the send sequence number which shows the last of said transmitting sequence is set up.

[Claim 12] Each of two or more of said transmit data has a header and data division. Said transmit data selection step for a duplicate It makes for the data size of said data division of each of said two or more transmit data to be zero into the selection condition of said transmit data for a duplicate. The data transmitting approach according to claim 10 characterized by using as said transmit data for a duplicate the transmit data with which the data size of said data division was judged, and the data size of said data division was judged to be zero about each of two or more of said transmit data.

[Claim 13] Said transmit data selection step for a duplicate each of two or more of said transmit data It makes into the selection condition of said transmit data for a duplicate to be the last division data of the division data which divided other transmit data into plurality. The data transmitting approach according to claim 10 characterized by using as said transmit data for a duplicate the transmit data which judged whether it was said last division data, and was judged to be said last division data about each of two or more of said transmit data.

[Claim 14] Said data transmitting approach has the data size reference-value record step which records further the data size reference value which is a reference value about the data size of transmit data. Said transmit data selection step for a duplicate each data size of two or more of said transmit data It makes into the selection condition of said transmit data for a duplicate to be below the data size reference value recorded on said data size reference-value record step. Said data size reference value and data size of two or more of said transmit data which were recorded on said data size reference-value record step are compared. The data transmitting approach according to claim 10 characterized by using as said transmit data for a duplicate the transmit data judged to be the data size below said data size reference value.

[Claim 15] According to the importance of data, the priority is set to each of two or more of said transmit data. Said data transmitting approach It has the priority reference-value record step which records the priority reference value which is a reference value about said priority. Furthermore, said transmit data selection step for a duplicate Said priority reference value recorded on said priority reference-value record step and said priority set as each of two or more of said transmit data are measured. The data transmitting approach according to claim 10 characterized by using as said transmit data for a duplicate the transmit data judged that the priority beyond said priority reference value is set up.

[Claim 16] According to the importance of data, the priority is set to each of two or more of said transmit data. Said data transmitting approach It has the priority reference-value record step which records the priority reference value which is a reference value about said priority. Furthermore, said transmit data selection step for a duplicate Even if it is the transmit data which measures said priority reference value recorded on said priority reference-value record step, and said priority set as each of two or more of said transmit data, and agrees in said selection condition The transmit data judged that the priority below said priority reference value is set up is the data transmitting approach according to claim 11

to 14 characterized by not considering as said transmit data for a duplicate.

[Claim 17] Said transmitting step resends said transmit data for a duplicate and said duplicate data. Said data transmitting approach Furthermore, the retry count record step which records the retry count of said transmit data for a duplicate based on said transmitting step, and said duplicate data, The retry count reference-value record step which records the retry count reference value which is a reference value about said retry count, The retry count comparison step which compares said retry count recorded on said retry count record step with said retry count reference value recorded on said retry count reference-value record step, It has the number record step of duplicate data duplicates which records the number of duplicates of said duplicate data which said duplicate data generation step generates to the same transmit data for a duplicate. Said retry count comparison step compares said retry count recorded on said retry count record step with said retry count reference value recorded on said retry count reference-value record step. When it is judged that said retry count is said beyond retry count reference value, the increment directions in the number of duplicates which direct the increment in said number of duplicates are outputted to said number record step of duplicate data duplicates. Said number

record step of duplicate data duplicates increases said number of duplicates according to said increment directions in the number of duplicates outputted from said retry count comparison step. Said duplicate data generation step The data transmitting approach according to claim 10 characterized by generating said duplicate data according to said number of duplicates recorded on said number record step of duplicate data duplicates.

[Claim 18] It is the data transmitting approach according to claim 10 which said data transmitting approach has further the transmitting spacing setting-out step which sets up transmitting spacing of transmission of said transmit data for a duplicate based on said transmitting step, and said duplicate data, and is characterized by for said transmitting step to transmit said transmit data for a duplicate and said duplicate data according to said transmitting spacing set up by said transmitting spacing setting-out step.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the method which shortens the response time of the communication link in the Local Area Network which does not guarantee especially dependability about the communications processing of an information processor.

[0002]

[Description of the Prior Art] As communication link mode of processing of the

conventional information processor, there was a thing as shown in JP,7-46289,A, for example. Drawing 26 is actuation of communication link mode of processing of such an information processor.

[0003] In this method, in order to shorten delay of the data transfer time by loss of the information frame in a Local Area Network, all information frames are resent irrespective of an information frame losing and bending. Even when loss of an information frame occurs by multiplexing and sending out an information frame, even if a receiving side does not publish a resending demand, it can receive resending and can shorten a data transfer time.

[0004]

[Problem(s) to be Solved by the Invention] In the above communication link mode of processing of an information processor, when a communication link packet lost, the data transfer time could be shortened compared with the case where the procedure of issuance of the resending demand from a receiving side and sending out of the resending data from a transmitting side is performed, but since all communication link packets were multiplexed, the communication band was halved as a result and there was a problem that the engine performance deteriorated as compared with the case where a communication link packet

does not lose.

[0005] This invention aims at shortening a data transfer time when loss occurs without decreasing a communication band by not having been made in order to cancel the above troubles, and multiplexing only the specific communication link packet which delay big when it loses generates, without adding modification to actuation of communications protocol processing.

[0006] Moreover, by changing a LAN driver and publishing a multiple-times Request to Send to a LAN controller, without replacing transmit data, this invention realizes a copy of data, without multiplexing a communication link packet, and aims at reducing the overheads of multiplexing.

[0007] Furthermore, this invention aims at setting up automatically the number of multiplexing of the same packet at the time of judging that a communication link packet is multiplexed according to network communication link quality.

[0008] This invention aims at setting up automatically the number of multiplexing of the same packet at the time of judging that a communication link packet is multiplexed according to network communication link quality.

[0009] This invention aims at preventing generating of overflow of the receiving-side buffer by a transmitting side transmitting a multiplexing packet

continuously.

[0010] This invention aims at multiplexing a communication link packet also in transmission of data smaller than assignment size, in order to prevent generating of the transmitting delay by loss of intermittent small data transmission.

[0011] It judges that communicative real-time requirement is required in processing of a priority that this invention is high, and aims at multiplexing a communication link packet also in transmission of the data from a process with a priority higher than an assignment priority.

[0012] Moreover, in low processing of a priority in which communicative real-time requirement is not thought as important, this invention does not judge packet multiplexing but aims at performing the same transmitting processing as the former.

[0013]

[Means for Solving the Problem] The data source concerning this invention is characterized by having the following elements.

(a) The transmit data selection section for a duplicate which chooses from two or more transmit data the transmit data set as the object of the duplicate of data as

transmit data for a duplicate, (b) The duplicate data generation section which generates the duplicate data which are the duplicate of said transmit data for a duplicate chosen by said transmit data selection section for a duplicate, (c) The transmitting section which transmits said transmit data for a duplicate, and said duplicate data of said transmit data for a duplicate when said duplicate data of said transmit data for a duplicate are generated by said duplicate data generation section.

[0014] The send sequence number which shows each transmitting sequence of two or more of said transmit data is set to each of two or more of said transmit data. Said data source It has the send-sequence-number Records Department which records the send sequence number which shows the last of transmitting sequence among said send sequence numbers. Furthermore, said transmit data selection section for a duplicate Said send sequence number set as each of two or more of said transmit data It makes into the selection condition of said transmit data for a duplicate to be the send sequence number which shows the last transmitting sequence before the send sequence number which shows the last of said transmitting sequence recorded on said send-sequence-number Records Department. The send sequence number which shows the last of said

transmitting sequence recorded on said send-sequence-number Records Department, Said send sequence number set as each of two or more of said transmit data is compared. It is characterized by using as said transmit data for a duplicate the transmit data judged that the send sequence number which shows the transmitting sequence before the send sequence number which shows the last of said transmitting sequence is set up.

[0015] It is characterized by using as said transmit data for a duplicate the transmit data with which each of two or more of said transmit data had a header and data division, said transmit data selection section for a duplicate made it for the data size of said data division of each of said two or more transmit data to be zero the selection condition of said transmit data for a duplicate, the data size of said data division was judged about each of two or more of said transmit data, and the data size of said data division was judged to be zero.

[0016] Said transmit data selection section for a duplicate is characterized by to use as said transmit data for a duplicate the transmit data which made it the selection condition of said transmit data for a duplicate for each of two or more of said transmit data to be the last division data of the division data which divided other transmit data into plurality, judged whether it was said last division data

about each of two or more of said transmit data, and was judged to be said last division data.

[0017] Said data source has the data size reference-value Records Department which records further the data size reference value which is a reference value about the data size of transmit data. Said transmit data selection section for a duplicate each data size of two or more of said transmit data It makes into the selection condition of said transmit data for a duplicate to be below the data size reference value recorded on said data size reference-value Records Department. Said data size reference value and data size of two or more of said transmit data which were recorded on said data size reference-value Records Department are compared, and it is characterized by using as said transmit data for a duplicate the transmit data judged to be the data size below said data size reference value.

[0018] According to the importance of data, the priority is set to each of two or more of said transmit data. Said data source It has the priority reference-value Records Department which records the priority reference value which is a reference value about said priority. Furthermore, said transmit data selection section for a duplicate Said priority reference value recorded on said priority reference-value Records Department and said priority set as each of two or

more of said transmit data are measured, and it is characterized by using as said transmit data for a duplicate the transmit data judged that the priority beyond said priority reference value is set up.

[0019] According to the importance of data, the priority is set to each of two or more of said transmit data. Said data source It has the priority reference-value Records Department which records the priority reference value which is a reference value about said priority. Furthermore, said transmit data selection section for a duplicate Even if it is the transmit data which measures said priority reference value recorded on said priority reference-value Records Department, and said priority set as each of two or more of said transmit data, and agrees in said selection condition It is characterized by not using as said transmit data for a duplicate the transmit data judged that the priority below said priority reference value is set up.

[0020] The account transmitting section resends said transmit data for a duplicate and said duplicate data. Said data source With furthermore, the retry count Records Department which records the retry count of said transmit data for a duplicate based on said transmitting section, and said duplicate data With the retry count reference-value Records Department which records the retry

count reference value which is a reference value about said retry count. The retry count comparator which compares said retry count recorded on said retry count Records Department with said retry count reference value recorded on said retry count reference-value Records Department. It has the number Records Department of duplicate data duplicates which records the number of duplicates of said duplicate data which said duplicate data generation section generates to the same transmit data for a duplicate. Said retry count comparator Said retry count recorded on said retry count Records Department is compared with said retry count reference value recorded on said retry count reference-value Records Department. When it is judged that said retry count is said beyond retry count reference value, the increment directions in the number of duplicates which direct the increment in said number of duplicates to said number Records Department of duplicate data duplicates are outputted. Said number Records Department of duplicate data duplicates increases said number of duplicates according to said increment directions in the number of duplicates outputted from said retry count comparator, and said duplicate data generation section is characterized by generating said duplicate data according to said number of duplicates recorded on said number Records Department of duplicate data

duplicates.

[0021] Said data source has further the transmitting spacing setting-out section which sets up transmitting spacing of transmission of said transmit data for a duplicate based on said transmitting section, and said duplicate data, and said transmitting section is characterized by transmitting said transmit data for a duplicate and said duplicate data according to said transmitting spacing set up by said transmitting spacing setting-out section.

[0022] The data transmitting approach concerning this invention is characterized by having the following elements. (a) The transmit data selection step for a duplicate which chooses from two or more transmit data the transmit data set as the object of the duplicate of data as transmit data for a duplicate, (b) The duplicate data generation step which generates the duplicate data which are the duplicate of said transmit data for a duplicate chosen by said transmit data selection step for a duplicate, (c) Transmitting step which transmits said transmit data for a duplicate, and said duplicate data of said transmit data for a duplicate when said duplicate data of said transmit data for a duplicate are generated by said duplicate data generation step.

[0023] The send sequence number which shows each transmitting sequence of

two or more of said transmit data is set to each of two or more of said transmit data. Said data transmitting approach It has the send-sequence-number record step which records the send sequence number which shows the last of transmitting sequence among said send sequence numbers. Furthermore, said transmit data selection step for a duplicate Said send sequence number set as each of two or more of said transmit data It makes into the selection condition of said transmit data for a duplicate to be the send sequence number which shows the transmitting sequence before the send sequence number which shows the last of said transmitting sequence recorded on said send-sequence-number record step. The send sequence number which shows the last of said transmitting sequence recorded on said send-sequence-number record step, Said send sequence number set as each of two or more of said transmit data is compared. It is characterized by using as said transmit data for a duplicate the transmit data judged that the send sequence number which shows the transmitting sequence before the send sequence number which shows the last of said transmitting sequence is set up.

[0024] It is characterized by using as said transmit data for a duplicate the transmit data with which each of two or more of said transmit data had a header

and data division, said transmit data selection step for a duplicate made it for the data size of said data division of each of said two or more transmit data to be zero the selection condition of said transmit data for a duplicate, the data size of said data division was judged about each of two or more of said transmit data, and the data size of said data division was judged to be zero.

[0025] Said transmit data selection step for a duplicate is characterized by to use as said transmit data for a duplicate the transmit data which made it the selection condition of said transmit data for a duplicate for each of two or more of said transmit data to be the last division data of the division data which divided other transmit data into plurality, judged whether it was said last division data about each of two or more of said transmit data, and was judged to be said last division data.

[0026] Said data transmitting approach has the data size reference-value record step which records further the data size reference value which is a reference value about the data size of transmit data. Said transmit data selection step for a duplicate each data size of two or more of said transmit data It makes into the selection condition of said transmit data for a duplicate to be below the data size reference value recorded on said data size reference-value record step. Said

data size reference value and data size of two or more of said transmit data which were recorded on said data size reference-value record step are compared, and it is characterized by using as said transmit data for a duplicate the transmit data judged to be the data size below said data size reference value.

[0027] According to the importance of data, the priority is set to each of two or more of said transmit data. Said data transmitting approach It has the priority reference-value record step which records the priority reference value which is a reference value about said priority. Furthermore, said transmit data selection step for a duplicate Said priority reference value recorded on said priority reference-value record step and said priority set as each of two or more of said transmit data are measured, and it is characterized by using as said transmit data for a duplicate the transmit data judged that the priority beyond said priority reference value is set up.

[0028] According to the importance of data, the priority is set to each of two or more of said transmit data. Said data transmitting approach It has the priority reference-value record step which records the priority reference value which is a reference value about said priority. Furthermore, said transmit data selection step for a duplicate Even if it is the transmit data which measures said priority

reference value recorded on said priority reference-value record step, and said priority set as each of two or more of said transmit data, and agrees in said selection condition It is characterized by not using as said transmit data for a duplicate the transmit data judged that the priority below said priority reference value is set up.

[0029] Said transmitting step resends said transmit data for a duplicate and said duplicate data. Said data transmitting approach Furthermore, the retry count record step which records the retry count of said transmit data for a duplicate based on said transmitting step, and said duplicate data, The retry count reference-value record step which records the retry count reference value which is a reference value about said retry count, The retry count comparison step which compares said retry count recorded on said retry count record step with said retry count reference value recorded on said retry count reference-value record step, It has the number record step of duplicate data duplicates which records the number of duplicates of said duplicate data which said duplicate data generation step generates to the same transmit data for a duplicate. Said retry count comparison step compares said retry count recorded on said retry count record step with said retry count reference value recorded on said retry count

reference-value record step. When it is judged that said retry count is said beyond retry count reference value, the increment directions in the number of duplicates which direct the increment in said number of duplicates are outputted to said number record step of duplicate data duplicates. Said number record step of duplicate data duplicates increases said number of duplicates according to said increment directions in the number of duplicates outputted from said retry count comparison step. Said duplicate data generation step According to said number of duplicates recorded on said number record step of duplicate data duplicates, it is characterized by generating said duplicate data.

[0030] Said data transmitting approach has further the transmitting spacing setting-out step which sets up transmitting spacing of transmission of said transmit data for a duplicate based on said transmitting step, and said duplicate data, and said transmitting step is characterized by transmitting said transmit data for a duplicate and said duplicate data according to said transmitting spacing set up by said transmitting spacing setting-out step.

[0031]

[Embodiment of the Invention] gestalt 1. of operation -- in order to aim at solution of this problem, it describes in what kind of case big communication link delay

occurs. Drawing 27 is an example of the configuration of the communication processing feature of the conventional information processor. As for an information processor and 2111, 2110 is [the communications protocol processing section and 2121] LAN drivers. As shown in drawing 28, the information processor of a transmitting side is connected to the information processor 3110 of a receiving side by LAN2140. The information processor 3110 of a receiving side is the same configuration as the information processor 2110 of a transmitting side. The communication link packet 2130 is sent to the receiving-side information processor 3110 from the transmitting-side information processor 2110. The communications protocol processing section 2111 has the following component, in order to realize communicative dependability. First, it has the information on the transmitting window size 2114 which shows the send sequence number 2112 which shows the data sequence transmitted to a degree until now as information which controls transmission, the send sequence number 2113 which shows the transmit data which received the confirmation of receipt from the receiving side received [Ack], and the transmit data size which can perform transmitting processing. Moreover, it has the received sequence number 2115 which shows the data sequence received until now as information

which controls reception, and the receiving window size 2116 which shows the received-data size which can perform reception. Furthermore, the communications protocol processing section has the timer processing 2150 for the periodic processing implementation in protocol processing. The timer processing 2150 consists of a timer 2151 and periodic processing 2152 which rises by that cause. It has transmit data in the waiting data 2118 for transmission which are the transmitting queue of a communications protocol. Moreover, although it transmitted, the transmit data which has not received the confirmation of receipt is also held as transmitted data 2117. It has received data in the received data 2119 until reception of application is performed. The received data which arrived newly are put on the ready-for-receiving ability field 2120.

[0032] In order to perform communications protocol processing, the following information is recorded on the header of the communication link packet 2130. 2131 is a sequence number and shows the data sequence of transmit data 2136. A sequence number 2131 is acquired from the send sequence number 2112 of transmission-control information. 2132 is an Ack number and an information processor shows the data sequence of data [finishing / reception]. The Ack number 2132 is obtained from the received sequence number 2115 of

reception-control information. 2133 is a window size and an information processor shows the data size in which reception is possible. A window size 2133 is obtained from the receiving window size 2116 of reception-control information. 2134 is the data size of the transmit data 2136 in the communication link packet 2130. 2135 is a division flag which shows whether the communication link packet is divided and consecutive commo data exists.

[0033] Such communication link mode of processing of an information processor shows the example of actuation at the time of losing a communication link packet to drawing 29. In drawing 29, when it transmits continuously with the (1) data 1, the (2) data 2, and the (3) data 3, it is an example when data 2 are lost. When an information processor (reception) receives the packet of data 3 by referring to the sequence number 2131 in the header of a communication link packet, it can detect that the packet of data 2 was lost. Thereby, a receiving side requires resending of data 2 by the Ack packet by (4), and the transmitting side which received it resends data 2 by (5). Since the delay by the data loss in this case is the time amount concerning both-way processing of a communication link packet, it serves as a permissible time delay in a high-speed Local Area Network.

[0034] The example of actuation of another case is shown in drawing 30 to it. In drawing 30, it is an example when the Ack packet which transmits from an information processor (reception) by (4) is lost. Although the information processor (transmission) transmitted continuously with the (1) data 1, the (2) data 2, and the (3) data 3, since (4) Ack to it is not received, the following transmit data cannot be transmitted. Moreover, since the following data do not arrive, an information processor (reception) does not transmit a new Ack packet, either. By the periodic processing 2152 of a timer, the communications protocol processing section detects that renewal of fixed time amount of the transmitting window size was not carried out by (5). In order for this to check the condition of a receiving side by (6), by transmitting an Ack packet from a transmitting side and answering the response to it from a receiving side by (7), loss of the Ack packet of (4) is detected and transmitting processing is resumed. The delay by the data loss in this case is decided by periodic time amount of the timer 2151 of the communications protocol processing section. Since this is usually the time amount of N times of 500 mses, as compared with a data transfer time when loss does not occur, very big delay generates it in a high-speed Local Area Network.

If generating in the condition that it is similar with such drawing 30 is prevented,

even if loss of a communication link packet arises, the time delay of data transfer can be made small.

[0035] Hereafter, the gestalt 1 of implementation of this invention is explained according to drawing. Drawing 1 is the functional block diagram of the data source by the gestalt 1 of implementation of this invention. The communications protocol processing section 10 in drawing 1 and the LAN driver 13 are the same as that of the communications protocol section 2111 and the LAN driver 2121 in drawing 27, and are the same as that of each element with which each element contained in the communications protocol section 10 of drawing 1 is also contained in the communications protocol processing section 2111 of drawing 27. In addition to the configuration shown in drawing 27, with the gestalt of this operation, it has the packet multiplexing control section 12. The packet multiplexing control section 12 consists of the multiplexing decision section 121 and the multiplexing packet sending-out section 122. The multiplexing decision section 121 chooses the transmit data (it multiplexes) (transmit data for a duplicate) which creates duplicate data among transmit data. Moreover, the multiplexing packet sending-out section 122 creates duplicate data per transmit data for a duplicate, and transmits the transmit data for a duplicate, and the

created duplicate data to the LAN driver 13. Moreover, as shown in drawing 2 , the data source 1 is connected with the data sink 2 through LAN2140 like the conventional information processor. Moreover, the data sink 2 has the same configuration as the data source 1.

[0036] Drawing 3 is the detail configuration of the packet multiplexing control section 12. The packet multiplexing control section 12 exists for every communication link connection which the communications protocol processing section 10 processes, and receives transmit data 140 from the communications protocol processing section 10. The header of transmit data 140 and the configuration of data are the same as the communication link packet 2130 of drawing 27 . The multiplexing decision section 121 of the packet multiplexing control section 12 has the send-sequence-number Records Department 123. The send-sequence-number Records Department 123 records the send sequence number of the data which last time transmitted (last send sequence number), i.e., the send sequence number which shows the last of transmitting sequence. In addition, about the role of the send-sequence-number Records Department 123, it mentions later. Moreover, the multiplexing decision section 121 functions as the transmit data selection section for a duplicate, and performs

multiplexing decision processing 124. That is, the multiplexing decision section 121 judges whether transmit data 140 is used as the transmit data for a duplicate from the information on the header unit of transmit data 140, and the information on data division. Moreover, the multiplexing decision section 121 passes the transmit data 140 chosen as transmit data for a duplicate to the multiplexing packet sending-out section 122, when multiplexing. When it is judged that it does not multiplex, it transmits to the LAN driver 13 like delivery and the former as it is.

[0037] The multiplexing packet sending-out section 122 functions as the duplicate data generation section, and consists of packet duplicate processing 125 and multiplexing packet transmitting processing 126. That is, the multiplexing packet sending-out section 122 generates the duplicate data which are the duplicate of transmit data 140 which received the transmit data 140 judged to be the transmit data for a duplicate in the multiplexing decision section 121 in reception and the packet duplicate processing 125, and creates a packet with the same data as transmit data 140. In the multiplexing packet transmitting processing 126, delivery and the LAN driver 13 transmit these data for the packet reproduced in the packet duplicate processing 125, and the packet which stored the transmit data 140 which is transmit data for a duplicate to the LAN

driver 13. In this case, multiple-times transmission of the transmit data 160 of the same content as transmit data 140 will be carried out as duplicate data.

[0038] The actuation by the whole gestalt 1 of implementation of this invention is explained using drawing 4. With the gestalt 1 of operation, when transmitting data, it operates as follows. In addition, the data transmitting approach based on the gestalt of this operation is also realized by the same procedure. First, the communications protocol processing section 10 performs transmitting protocol processing by S110. Thereby, the data which should be transmitted are put on the waiting data 112 for transmission. Next, by S120, whether the multiplexing decision section's 121 performing multiplexing of reception and transmit data for transmit data from the waiting data 112 for transmission and multiplexing decision processing are performed. When it is judged that a transmitting packet is multiplexed by S130, the multiplexing packet sending-out section performs generation of a call and duplicate data, i.e., the duplicate of a packet, for the packet duplicate processing 125 by S140. And by S150, a LAN driver transmits a packet for the packet of the transmit data 160 with which the multiplexing packet sending-out section 122 was reproduced with the packet of a call and transmit data 140 in the multiplexing packet transmitting processing 126 to the

LAN driver 13 in delivery and S160, the case where it is judged that it does not multiplex by S130 -- as it is -- the LAN driver 13 transmits a packet for the transmit data of the waiting data 112 for transmission to the LAN driver 13 by delivery and S160 in a network. Here, S120 to S150 is the new processing added with the gestalt of this operation. S110 and S160 perform the same actuation as the former. In this invention, a receiving side performs the same actuation as the former. Since the processing which discards the same packet is incorporated when this receives two or more same packets for the reception of a communications protocol, even when a packet is multiplexed, processing special to a receiving side is because it is not needed.

[0039] The detail of each processing of S120, S140, and S150 added with the gestalt of this operation is explained. Drawing 5 is the detail of S120 multiplexing decision processing. The multiplexing decision section 121 performs this. In S120, the multiplexing decision section 121 judges whether transmit data 140 agrees in the selection condition (henceforth multiplexing conditions) set up for selection of the transmit data for a duplicate. Three multiplexing conditions are set up with the gestalt of this operation.

[0040] In S121, the multiplexing decision section 121 checks whether it is below

a send sequence number (sequence number which shows the last of transmitting sequence) last time by which the sequence number 141 in the header of transmit data 140 was recorded on the send-sequence-number Records Department 123. Last time which was recorded, since the send sequence number below a send sequence number is a send sequence number which shows the transmitting sequence before the transmit data transmitted at the end, it judges it as transmission of a resending packet, and it judges with multiplexing a transmitting packet, and a transmitting packet is multiplexed (S125). When the sequence number 141 of transmit data 140 is more than a send sequence number last time which was recorded on the send-sequence-number Records Department 123, it progresses to S122.

[0041] In S122, the multiplexing decision section 121 checks whether the data size 144 of the data division of transmit data 140 is 0. That data size is 0 becomes the Ack packet which notifies that the window size 143 in which the data 146 which should be transmitted do not exist was updated. It judges with multiplexing a transmitting packet also in this case, and a transmitting packet is multiplexed (S125). When the data size of transmit data is not 0, it progresses to S123.

[0042] In S123, it checks whether it is shown that the multiplexing decision section 121 is data with which the transmit data 140 was divided from other data with reference to the division flag of transmit data 140, and is the packet of the last part of the divided data. In this case, it is judged as the last packet of continuation data, and judges with multiplexing a transmitting packet, and a transmitting packet is multiplexed (S125).

[0043] When transmit data is applied to which conditions of S121 to S123, according to drawing 6, it moves to processing of S140. When applied to neither of the conditions of S121 to S123, it judges with not multiplexing a transmitting packet by S124. When not multiplexing, according to drawing 4, the packet transmitting processing conventional by S160 is performed. In this case, the transmit data 140 received from the communications protocol processing section 10 is passed to the LAN driver 13 as it is.

[0044] According to the property of the communication link performed by the system, selection of conditions is performed and the multiplexing conditions in the flow chart of drawing 5 can also make a change of sequence. Moreover, new conditions can also be added. In simple communications protocol processing, the judgment of multiplexing conditions in which the communications protocol

processing to be used does not have a part of transmit/receive control information 103-107 and which need the information is removed, and it applies the multiplexing decision processing S120.

[0045] Drawing 6 is the detail of the packet duplicate processing S140. The multiplexing packet sending-out section 122 performs this. In S140, when it judges with multiplexing a packet by S120, the packet for transmitting a transmitting packet with the same data is reproduced. First, the multiplexing packet sending-out section 122 gains the memory area on which the reproduced transmit data is put from an operating system by S141. This uses a conventional means to gain the memory area for transmit data. Next, by S142, the multiplexing packet sending-out section 122 copies the content of the header in transmit data 140, and all data to the memory area gained by S141. This serves as the transmit data 160 which is duplicate data.

[0046] Drawing 7 is the detail of the multiplexing packet transmitting processing S150. The multiplexing packet sending-out section 122 performs this. Multiplexed transmitting processing of a packet is performed in S150. This is realized with the gestalt of this operation, using the packet transmitting processing S160 (drawing 4) of a LAN driver as it is. First, delivery and

transmitting processing are requested from the LAN driver 13 for the transmit data 140 which is the original data in S151. Next, delivery and transmitting processing are requested from the LAN driver 13 for the transmit data 160 reproduced by S152. Since 13 performs all transmitting processings of which transmitting processing is demanded by the LAN driverS160, transmitting processing of the transmit data 160 which is the original transmit data 140 and the duplicate data which are transmit data for a duplicate will be performed, and multiplexed transmission of a packet will be performed.

[0047] Since according to the data source by the gestalt 1 of this operation only the transmitting packet which produces big delay was multiplexed when it lost, a data transfer time when a communication link packet loses can be shortened without decreasing a communication band. Moreover, the conventional communications protocol cannot be changed but the method to add can realize such a device.

[0048] Below gestalt 2. of operation explains the gestalt 2 of implementation of this invention according to drawing. Although the data source of the gestalt 2 of operation is the same configuration as drawing 1 of the gestalt 1 of operation, it has the configuration [like drawing 8] whose packet multiplexing control section

12 and LAN driver 13 are. The thing of the same number as drawing 3 is the same component as drawing 3 among drawing 8. With the gestalt 2 of operation, the multiplexing packet registration section 127 is formed instead of the multiplexing packet sending-out section 122. The multiplexing packet registration section 127 performs multiplexing packet registration processing 128 instead of the packet duplicate processing 125 of the gestalt 1 of operation, and the multiplexing packet transmitting processing 126. Moreover, in the LAN driver 13, it newly has the multiplexing demand flag 131 and the multiplex transmitting processing section 132. The multiplexing demand flag 131 is data held for every transmit data in a LAN driver, and is a flag which shows whether applicable transmit data is multiplexed and it transmits. Unlike the gestalt 1 of operation, without creating the transmit data 160 which is duplicate data within the packet multiplexing control section 12, in the multiplexing transmitting processing section 132 of a LAN driver, duplicate data are generated and multiplex transmission is performed with the gestalt 2 of operation. Therefore, the multiplex transmitting processing section 132 in the LAN driver 13 achieves the function of the duplicate data generation section and the transmitting section.

[0049] The actuation by the whole gestalt 2 of implementation of this invention is

shown in drawing 9. In addition, the data transmitting approach based on the gestalt of this operation is also realized by the same procedure. With the gestalt 2 of operation, processing of S110, S120, S130, and S160 carries out the same actuation as the gestalt 1 of operation, and only processings of the multiplexing packet registration section 127 at the time of judging that it multiplexes differ. With the gestalt 2 of operation, a judgment whether transmit data is multiplexed by S120 is made, and when it is judged that transmit data is multiplexed by S130, the multiplexing packet registration section 127 registers a multiplex Request to Send for the multiplexing packet registration processing 128 to a call and a LAN driver by S210. In a LAN driver, the duplicate data of a call and the transmit data for a duplicate are generated for the multiplex transmitting processing section 132, and multiplex transmission is performed S220.

[0050] Drawing 10 and drawing 11 explain detail actuation of S210 multiplexing

packet registration processing and S220 multiplex transmitting processing.

Drawing 10 is the detail of the multiplexing packet registration processing S210.

The multiplexing packet registration section 127 performs this. Transmit data

140 is registered into the transmitting queue of a LAN driver in S211. And in

S212, the multiplexing demand flag 131 of the LAN driver corresponding to

transmit data 140 is set as "multiplexing."

[0051] Drawing 11 is the detail of S220 multiplex transmitting processing. The LAN driver 13 performs this. In S221, the LAN driver 13 acquires transmit data from the transmitting queue of a LAN driver. Next, it checks whether the multiplexing demand flag 131 is set as the transmit data by "multiplexing" by S222. When the multiplexing demand flag 131 is not set as "multiplexing", a Request to Send is published for a LAN controller as usual by S223, and a communication link packet is sent out to LAN. When the multiplexing flag 131 is set as the transmit data by "multiplexing" by S222, it moves to S224. A Request to Send is published for the transmit data 140 which is transmit data for a duplicate by delivery and S225 in the multiplex transmitting processing section 132 S224 at the multiplex transmitting processing section 132. Furthermore, multiplexing of transmit data is again realized by publishing a Request to Send in the multiplex transmitting processing section 132, without changing transmit data by S226. The approach of S226 uses the multiplex transmitting processing section 132 as a LAN controller, puts transmit data 140 on the memory on a LAN controller, and when performing transmitting processing by writing a transmitting command in a command register, it performs it by reusing the data on the

memory of a LAN controller. When a LAN controller performs transmitting processing by the direct DMA transfer from the primary storage of the data source, it carries out by specifying the transmit data of the same memory area as a two or more LAN controller. When performing transmitting processing by writing transmit data in the register of a LAN controller, it carries out by writing the same transmit data in a register.

[0052] Since according to the data source by the gestalt 2 of this operation transmit data is not copied and it was made to realize multiplexing of a communication link packet by the multiplex transmission in a LAN driver, the overheads of software-multiplexing processing are reducible.

[0053] Below gestalt 3. of operation explains the gestalt 3 of implementation of this invention according to drawing. In the data source of the gestalt 3 of operation, it has the same configuration as drawing 1 of the gestalt 1 of operation, and drawing 3. However, unlike the gestalt 1 of operation, the timer processing 100 of the communications protocol processing section becomes like drawing 12. With the gestalt 3 of operation, in addition to the configuration of the gestalt 1 of operation, it has the retry count Records Department 115, the retry count reference-value Records Department 116, and the retry count comparator

117 in the timer processing 100, and actuation of the periodic processing 102 differs. Here, the retry count Records Department 115 records a retry count, when resending of the transmit data slack transmit data 140 for a duplicate and the duplicate data slack transmit data 160 is performed. The retry count reference-value Records Department 116 is recording the retry count reference value which shows the upper limit of a retry count. Moreover, the retry count comparator 117 compares the retry count recorded on the retry count Records Department 115 with the retry count reference value recorded on the retry count reference-value Records Department 116. Moreover, the multiplexing packet sending-out section 122 has composition like drawing 13, and differs from the multiplexing packet sending-out section in the gestalt 1 of operation. With the gestalt 3 of operation, in addition to the configuration of the gestalt 1 of operation, it has the number Records Department 120 of multiplexing of a packet in the multiplexing packet sending-out section 122, and the procedure of the packet duplicate processing 125 differs. In addition, the number Records Department 120 of multiplexing is recording, the number of duplicates, i.e., number of multiplexing, at the time of reproducing the transmit data for a duplicate.

[0054] Drawing 14 explains actuation of the periodic processing 102 in timer

processing of the gestalt 3 of implementation of this invention. The data transmitting approach based on the gestalt of this operation is also realized by the same procedure. The periodic processing 102 rises for every period specified with the timer 101. First, it distinguishes whether there are any data (the transmit data for a duplicate and duplicate data) which should be resent by S301 at the time of rising. Whether there are any resending data based on a timer judges by whether the resend timer which communications protocol processing has expired. When a resend timer does not expire in S301 but there are no data which should be resent, it moves to S306 and the same periodic processing as the former is performed. When there are data which should be resent by S301, it moves to S302, and the retry count recorded on the retry count Records Department 115 is incremented. Furthermore, the retry count comparator 117 checks whether it has become beyond the retry count reference value with which the retry count recorded on the retry count Records Department 115 was recorded on the retry count reference-value Records Department 116 by S303. When the retry count recorded on the retry count Records Department 115 is smaller than a retry count reference value, the same periodic processing as the former is performed by S306. When the retry count recorded on the retry

count Records Department 115 by S303 becomes beyond a retry count reference value, the retry count comparator 117 issues [increasing the number of multiplexing to the number Records Department 120 of multiplexing, and] directions, and the number Records Department 120 of multiplexing increments the number of multiplexing (S304). The number of multiplexing of transmit data will increase by this. The retry count furthermore recorded on the retry count Records Department 115 by S305 is reset, and it enables it to count generating of resending by the timer again. The same periodic processing as the former is performed by S306 after processing of S305.

[0055] The actuation by the whole transmitting processing of the gestalt 3 of operation is the same as drawing 4 of the gestalt 1 of operation. With the gestalt 3 of operation, the actuation S140 of the packet duplicate processing at the time of judging that a transmitting packet is multiplexed by S130 differs. Drawing 15 explains the detail of S140 packet duplicate processing. By S311, the multiplexing packet sending-out section 122 checks whether multiplexing processing for the count specified with the number of multiplexing recorded on the number Records Department 120 of multiplexing has been performed with reference to the number of multiplexing recorded on the number Records

Department 120 of multiplexing. When it is judged that multiplexing processing for the count specified with the number of multiplexing recorded on the number Records Department 120 of multiplexing by S311 is omitted, the multiplexing packet sending-out section 122 builds the duplicate of the transmitting packet for the count specified with the number of multiplexing recorded on the number Records Department 120 of multiplexing with processing of S141 and S142. The packet which stored the transmit data 140 which are all transmit data 160 and transmit data for a duplicate that were created here, and that were reproduced is transmitted by S150. Thus, in the data source in the gestalt of this operation, the number of transmission of the same packet at the time of judging that it multiplexes is changeable by incrementing the number of multiplexing recorded on the number Records Department 120 of multiplexing. In addition, the data transmitting approach based on the gestalt of this operation is also realized by the same procedure.

[0056] According to the data source by the gestalt 3 of this operation, since it was made to increase the number of multiplexing of a communication link packet according to the count of accumulation of generating or resending of the packet by the timer, according to network communication link quality, the number of

multiplexing can be set up automatically.

[0057] Below gestalt 4. of operation explains the gestalt 4 of implementation of this invention according to drawing. The data source of the gestalt 4 of operation is obtained with the configuration of the gestalt 2 of operation of the effectiveness of the gestalt 3 of operation. The gestalt 4 of operation has the configuration of drawing 8 like the gestalt 2 of operation. However, the timer processing 100 of the communications protocol processing section serves as a configuration of the same drawing 12 as the gestalt 3 of operation. Moreover, unlike the gestalt 2 of operation, the LAN driver 13 of the gestalt 4 of operation serves as a configuration of drawing 16. In addition to the multiplexing demand flag 131, the LAN driver 13 has the number Records Department 120 of multiplexing of a packet, and actuation of the multiplex transmitting processing 132 differs.

[0058] With the gestalt 4 of implementation of this invention, the periodic processing 102 of the timer processing 100 of the communications protocol processing section 10 serves as actuation of drawing 14 like the gestalt 3 of operation. Moreover, the actuation by the whole transmitting processing is the same as drawing 9 of the gestalt 2 of operation. Although S210 shown in

drawing 9 carries out the same actuation as the gestalt 2 of operation with the gestalt 4 of operation, actuation of the multiplex transmitting processing S220 in a LAN driver differs. The detail of actuation of the multiplex transmitting processing S220 is shown in drawing 17. In the multiplex transmitting processing S220, although the processing to S225 is the same as the gestalt 2 of operation, a Request to Send is published in the multiplex transmitting section S226 using the same transmit data until it reaches the number of multiplexing in S321 after that with reference to the number of multiplexing recorded on the number Records Department 120 of multiplexing. Thus, by incrementing the number of multiplexing recorded on the number Records Department 120 of multiplexing, the number of transmission of the same packet is changeable. In addition, the data transmitting approach based on the gestalt of this operation is also realized by the same procedure.

[0059] According to the data source by the gestalt 4 of this operation, in the same configuration as the gestalt 2 of operation, the number of multiplexing can be automatically set up according to network communication link quality.

[0060] Below gestalt 5. of operation explains the gestalt 5 of implementation of this invention according to drawing. The data source of the gestalt 5 of operation

controls transmitting spacing of a multiplexing packet by continuous transmission of the multiplexing packet in the gestalt 2 of operation, in order to prevent generating of overflow of a receiving-side buffer. loss of a communication link packet is based on the overflow of not only the data loss on a network but a receiving-side buffer -- taking -- spilling -- it generates in many cases. With the gestalt 2 of operation, in transmission of a multiplexing packet, since it can publish continuously, there is a danger that a resending packet will also be lost by the receiving overflow, about the Request to Send to the multiplex transmitting processing section 132. The gestalt 5 of operation avoids this problem. The gestalt 5 of operation has the configuration of drawing 8 like the gestalt 2 of operation. However, the LAN driver 13 differs from the gestalt 2 of operation, as shown in drawing 18 . The LAN driver 13 of the gestalt 5 of operation has the transmitting spacing setting-out section 133. The transmitting spacing setting-out section 133 adjusts transmitting spacing of a multiplexing packet by controlling issuance spacing of the Request to Send to the multiplex transmitting processing section 132. Control of issuance spacing of the Request to Send to the multiplex transmitting processing section 132 is performed based on the transmitting time delay 134 which specified the issuance spacing time

amount of a Request to Send. Moreover, unlike the multiplex transmitting processing S220 shown in drawing 11, in the gestalt 5 of operation, it differs from the gestalt 2 of operation also at the point which serves as the multiplex [with transmitting delay] transmitting processing S220 as shown in drawing 19.

[0061] With the gestalt 5 of implementation of this invention, the actuation by the whole transmitting processing operates drawing 9 like the gestalt 2 of operation.

Although S210 carries out the same actuation as the gestalt 2 of operation with the gestalt 5 of operation, the multiplex transmitting processing S220 in the LAN driver 13 changes to the multiplex [with transmitting delay] transmitting processing S220. The detail of actuation of the multiplex [with transmitting delay] transmitting processing S220 is shown in drawing 19. In multiplex transmitting processing, although the processing to S225 is the same as the gestalt 2 of operation, with reference to the transmitting time delay 134, it waits for the transmitting spacing setting-out section 133 the time specified there after that S401. By the engine performance of a receiving-side information processor, this assignment time amount is several 10 microseconds from several microseconds. It waits for this assignment time amount by approaches, such as a wait by the busy loop formation or high-speed context switching. The same

actuation as the gestalt 2 of the operation which does not perform waiting for resending can also be made to perform by setting the transmitting time delay 134 to 0. The transmitting spacing setting-out section 133 publishes a Request to Send to the multiplex transmitting processing section 132 after S401 using the same transmit data. Thus, since the transmitting spacing setting-out section 133 adjusts transmitting spacing with reference to a transmitting time delay, allowances to make reception performing to a receiving side can be made. In addition, the data transmitting approach based on the gestalt of this operation is also realized by the same procedure.

[0062] Since according to the data source by the gestalt 5 of this operation a fixed time delay is set and the same packet was transmitted in the configuration of the gestalt 2 of operation when multiplexing transmission was performed, the processing overflow of the receiving side by continuous transmission can be prevented.

[0063] Below gestalt 6. of operation explains the gestalt 6 of implementation of this invention according to drawing. The data source of the gestalt 6 of operation aims at preventing generating of delay of the big data transfer by loss of intermittent transmission of small data in the gestalt 1 of operation, or the gestalt

2 of operation. In the communication link of information processing system, a communication link which exchanges little data by the fixed cycle of the order for several seconds from several 10 mses exists. In this case, since it cannot detect unless it is timer processing of a communications protocol when it becomes intermittent transmission of one communication link packet and this data loses, big transfer delay occurs. In order to solve this, with the gestalt 6 of operation, transmission of data smaller than the fixed size which is not divided is judged to be intermittent transmission of small data, and a communication link packet is multiplexed automatically. Moreover, since data size is small, reduction of the communication band depended also for multiplexing is small. Although the data source of the gestalt 6 of operation has the configuration of drawing 1 and drawing 3 like the gestalt 1 of operation, the multiplexing decision sections 121 differ. The configuration of the multiplexing decision section is shown in drawing 20. With the gestalt 6 of operation, it has the data size reference-value Records Department 129 which recorded the data size reference value which shows the threshold of the transmit data size for judging whether a communication link packet is multiplexed on the multiplexing decision section 121. Moreover, actuation of the multiplexing decision processing 124 differs.

[0064] With the gestalt 6 of implementation of this invention, the actuation by the whole transmitting processing performs actuation shown in drawing 4 like the gestalt 1 of operation. With the gestalt 6 of operation, actuation of the multiplexing decision processing in the multiplexing decision section 121 of S120 differs. The detail of actuation of the multiplexing decision processing 124 in the gestalt 6 of operation is shown in drawing 21. With the gestalt 6 of operation, the judgment of the multiplexing conditions from S121 to S123 is performed like the gestalt 1 of operation. Then, the multiplexing decision section 121 judges the conditions further added by S601. In S601, the data size 144 of the data division of transmit data 140 and the division flag 145 are compared with the data size reference value recorded on the data size reference-value Records Department 129, and transmit data is not divided, but the multiplexing decision section 121 judges whether it is below the data size reference value with which the transmit data size 144 was recorded on the data size reference-value Records Department 129. When it agrees on the multiplexing conditions 4, it expects that it is intermittent transmission, and it is judged that a transmitting packet is multiplexed by S125. The data size reference value recorded on the data size reference-value Records Department 129 is a value set up from the

communication link design of a system. The same actuation as the gestalt 1 of operation can also be made to perform by setting a data size reference value as 0. The transmit data it was judged that multiplexed is passed to the multiplexing packet sending-out section 122 by S130 of drawing 4, and operates the gestalt 1 of operation, and the gestalt 2 of operation. Thereby, multiplexing of a communication link packet is performed. In addition, the data transmitting approach based on the gestalt of this operation is also realized by the same procedure.

[0065] According to the data source by the gestalt 6 of this operation, in the same configuration as the gestalt 1 of operation, or the gestalt 2 of operation, since the communication link packet of transmit data smaller than assignment size was multiplexed, generating of the big transfer delay time amount by loss of the communication link packet of little intermittent transmission can be prevented.

[0066] Below gestalt 7. of operation explains the gestalt 7 of implementation of this invention according to drawing. The data source of the gestalt 7 of operation aims at preventing generating of the communication link delay by loss of the transmit data of high processing of especially a priority in the gestalt 1 of operation, or the gestalt 2 of operation. With the gestalt 7 of operation, the data

transmission from the process that a priority is high is judged to be the required communication link of real-time requirement, and a communication link packet is multiplexed automatically. Although the gestalt 7 of operation has the configuration of drawing 1 and drawing 3 like the gestalt 1 of operation, the multiplexing decision sections 121 differ. The configuration of the multiplexing decision section 121 is shown in drawing 22. With the gestalt 7 of operation, it has the processing priority 701 in the multiplexing decision section 121. The processing priority 701 is a priority of the process which transmits the applicable transmit data obtained from the process priority 711 in the process information 710 which an operating system manages. Furthermore, the multiplexing decision section 121 has the priority reference-value Records Department 702 which is recording the priority reference value 703 used as the threshold which judges whether it multiplexes or not. Moreover, as shown in drawing 23, the procedure of the multiplexing decision processing S120 by the multiplexing decision section 121 differs from the gestalt 1 of operation, or the gestalt 2 of operation.

[0067] With the gestalt 7 of implementation of this invention, the actuation by the whole transmitting processing operates drawing 4 like the gestalt 1 of operation.

With the gestalt 7 of operation, actuation of the multiplexing decision processing in the multiplexing decision section of S120 differs. The detail of actuation of the multiplexing decision processing 124 in the gestalt 7 of operation is shown in drawing 23. With the gestalt 7 of operation, the judgment of the multiplexing conditions from S121 to S123 is performed like the gestalt 1 of operation. Then, the multiplexing decision section 121 judges the conditions further added by S701. In S701, the multiplexing decision section 121 measures the priority reference value 703 and the processing priority 701, and judges whether the processing priorities 701 are 703 or more priority reference values. When it agrees on conditions, it considers as data transmission of high priority processing, and it is judged that a transmitting packet is multiplexed by S125.

The value of the priority reference value 703 sets up the threshold from the priority design of processing in a system. The transmit data it was judged that multiplexed is passed to the multiplexing packet sending-out section 122 by S130 of drawing 4, and operates the gestalt 1 of operation, and the gestalt 2 of operation. Thereby, multiplexing of a communication link packet is performed. In addition, the data transmitting approach based on the gestalt of this operation is also realized by the same procedure.

[0068] Since the transmit data of the transmitting process in which a priority has beyond an assignment value was multiplexed in the same configuration as the gestalt 1 of operation, or the gestalt 2 of operation according to the data source by the gestalt 7 of this operation, generating of the big transfer delay time amount by loss of the communication link packet of data transmission of severe processing of real-time constraint can be prevented.

[0069] Below gestalt 8. of operation explains the gestalt 8 of implementation of this invention according to drawing. In the gestalt 1 of operation, or the gestalt 2 of operation, to transmission of low processing of the unnecessary priority of communicative real-time requirement, the data source of the gestalt 8 of operation is not concerned with the conditions of multiplexing decision of the gestalt 1 of operation, and does not multiplex a packet, but transmits it by the same approach as the former. Although the data source of the gestalt 8 of operation has the configuration of drawing 1 and drawing 3 like the gestalt 1 of operation, the multiplexing decision sections 121 differ. The configuration of the multiplexing decision section is shown in drawing 24. With the gestalt 8 of operation, it has the processing priority 701 in the multiplexing decision section like the gestalt 7 of operation. Furthermore, the multiplexing decision section has

the multiplexing minimum priority reference value 802 used as the threshold which does not multiplex. The multiplexing minimum priority reference value 802 is recorded on the priority reference-value Records Department 702. Transmitting processing of a priority lower than the multiplexing minimum priority reference value 802 is not concerned with the multiplexing conditions of transmit data, and does not multiplex a packet. Moreover, actuation of the multiplexing decision processing 124 differs.

[0070] The data source of the gestalt 8 of implementation of this invention operates drawing 4 like the gestalt 1 of operation about actuation by the whole transmitting processing. However, with the gestalt 8 of operation, actuation of the multiplexing decision processing in the multiplexing decision section of S120 differs. The detail of actuation of the multiplexing decision processing 124 in the gestalt 8 of operation is shown in drawing 25. With the gestalt 8 of operation, first, the multiplexing decision section 121 compares the processing priority 701 of a process and the multiplexing minimum priority reference value 802 which required transmission by S801, and it judges whether the processing priority 701 is lower than the multiplexing minimum priority reference value 802. When it agrees on conditions (i.e., when the processing priority 701 is lower than a

multiplexing minimum priority reference value), it is judged that a transmitting packet is not multiplexed by S124, without performing the judgment of the multiplexing conditions from S121 to S123. If the processing priority 701 is beyond a multiplexing minimum priority reference value, the multiplexing conditions from S121 to S123 as well as the gestalt 1 of operation are judged, and when it agrees on conditions, it will be judged that a transmitting packet is multiplexed by S125. The value of the multiplexing minimum priority reference value 802 sets up the threshold from the priority design of processing in a system. By combining with the gestalt 7 of operation, when the priority of a transmitting process is lower than the multiplexing minimum priority reference value 802, it cannot multiplex, but in the case of 703 or more priority reference values, actuation of surely multiplexing can be obtained. In addition, the data transmitting approach based on the gestalt of this operation is also realized by the same procedure.

[0071] Since the transmit data of the transmitting process that a priority is lower than an assignment value is not concerned with conditions but it was made not to multiplex it in the same configuration as the gestalt 1 of operation, or the gestalt 2 of operation according to the data source by the gestalt 8 of this

operation, to data transmission or processing without the need for real-time constraint, the same actuation as the former is performed and the load of a channel is not raised.

[0072] Here, it is as follows when the description of this invention explained so far is summarized. In the communication link between the information processors in the Local Area Network which may generate a data loss, it has the packet multiplexing control section which sends out a transmitting packet for the packet which transmits to other information processors to reception and a LAN driver from the communication link (mode-of-processing a) communications protocol processing section with the following descriptions.

(b) A packet multiplexing control section has the multiplexing decision section which judges whether the packet which transmits is multiplexed, and the multiplexing packet sending-out section which multiplexes a transmitting packet and is sent out to a LAN driver.

(c) The multiplexing decision section judges it whether a packet is multiplexed or not to be the sequence number and data size which are contained in the header of a transmitting packet by the comparison with a send sequence number or limit data size last time which it has in multiplexing decision circles.

(d) The multiplexing packet sending-out section has the packet duplicate processing which creates the duplicate of the packet which transmits, and the multiplexing packet transmitting processing which sends out the reproduced packet to a LAN driver.

[0073] Furthermore, it has the multiplexing demand flag which shows that transmit data is multiplexed to the communication link (mode-of-processing a) LAN driver of an information processor with the following descriptions, and it transmits to it.

(b) A LAN driver has multiplex transmitting processing in which multiple-times transmitting processing of the same data is performed, to the transmit data with which the multiplexing demand flag is set up.

(c) Multiplex transmitting processing realizes multiplexing transmission by carrying out multiple-times issuance of the Request to Send to a LAN controller, without changing data.

(d) The multiplexing packet sending-out section in a packet multiplexing control section has multiplexing packet registration processing instead of the packet duplicate processing which creates the copy of transmit data.

(e) Multiplexing packet registration processing notifies multiplexing of transmit

data to a LAN driver by not creating the copy of transmit data but setting up the multiplexing demand flag of a LAN driver.

[0074] Furthermore, the count of generating of resending by the timer is detected by the periodic processing periodically started by the timer of the communication link (mode-of-processing a) communications protocol processing section of an information processor with the following descriptions.

(b) It has the number of multiplexing of the packet which shows the count of transmission of the same packet in the multiplexing packet sending-out section.

(c) Packet duplicate processing makes the duplicate of the packet for several multiplexing minutes, when multiplexing a packet with reference to the number of multiplexing of a packet.

(d) When the count of generating of resending by the timer exceeds the set-up threshold, increase the number of multiplexing.

[0075] Furthermore, the count of generating of resending by the timer is detected by the periodic processing periodically started by the timer of the communication link (mode-of-processing a) communications protocol processing section of an information processor with the following descriptions.

(b) It has the number of multiplexing of the packet which shows the count of

transmission of the same packet in a LAN driver.

(c) Multiplex transmitting processing of a LAN driver carries out continuation issuance of the Request to Send for several multiplexing minutes, when multiplexing a packet with reference to the number of multiplexing of a packet.

(d) When the count of generating of resending by the timer exceeds the set-up threshold, increase the number of multiplexing.

[0076] Furthermore, when performing multiplex transmission of the same packet to the communication link (mode-of-processing a) LAN driver of an information processor with the following descriptions, it has the transmitting time delay which specifies the latency time to resending packet transmission.

(b) A LAN driver delays the time amount and Request-to-Send issuance which were specified with reference to a transmitting time delay, when performing multiplex transmission.

[0077] Furthermore, it has the multiplexing packet size which shows the threshold of the data size of the transmit data which multiplexes a communication link packet in the communication link (mode-of-processing a) multiplexing decision section of an information processor with the following descriptions.

(b) Judge that in addition to the conditions of multiplexing decision of claim 1 multiplexing decision processing will multiplex a transmitting packet with reference to a multiplexing packet size if transmit data size is below a multiplexing packet size, and it passes transmit data to the multiplexing packet sending-out section.

[0078] Furthermore, it has the multiplexing priority which shows the threshold of the priority of the transmitting processing which multiplexes a communication link packet in the communication link (mode-of-processing a) multiplexing decision section of an information processor with the following descriptions.

(b) It has the processing priority which shows the priority of the process which performed the Request to Send in the multiplexing decision section.

(c) Judge that in addition to the conditions of multiplexing decision of claim 1 multiplexing decision processing will multiplex a transmitting packet with reference to a processing priority and a multiplexing priority if the processing priority of transmitting processing is beyond a multiplexing priority, and it passes transmit data to the multiplexing packet sending-out section.

[0079] Furthermore, it has the multiplexing minimum priority which shows the threshold of the priority of the transmitting processing which does not need to

multiplex a communication link packet in the communication link (mode-of-processing a) multiplexing decision section of an information processor with the following descriptions.

(b) It has the processing priority which shows the priority of the process which performed the Request to Send in the multiplexing decision section.

(c) With reference to a processing priority and a multiplexing priority, before multiplexing decision processing makes a multiplexing judgment, when the processing priority of transmitting processing is smaller than a multiplexing minimum priority, it is not concerned with multiplexing conditions, but judge that it does not multiplex a transmitting packet, and it passes transmit data to the multiplexing packet sending-out section.

[0080]

[Effect of the Invention] Since according to this invention only the transmitting packet which produces big delay was multiplexed when it lost, a data transfer time when a communication link packet loses can be shortened without decreasing a communication band. Moreover, the conventional communications protocol cannot be changed but the method to add can realize such a device.

[0081] Moreover, since according to this invention transmit data is not copied

and it was made to realize multiplexing of a communication link packet by the multiplex transmission in a LAN driver, the overheads of software-multiplexing processing are reducible.

[0082] Moreover, according to this invention, since it was made to increase the number of multiplexing of a communication link packet according to the count of accumulation of generating of resending of the packet by the timer, according to network communication link quality, the number of multiplexing can be set up automatically.

[0083] Moreover, since according to this invention a fixed time delay is set and the same packet was transmitted when multiplexing transmission was performed, the processing overflow of the receiving side by continuous transmission can be prevented.

[0084] Furthermore, according to this invention, since the communication link packet was multiplexed in the case of the transmit data smaller than assignment size, generating of the big transfer delay time amount by loss of the communication link packet of little intermittent transmission can be prevented.

[0085] Since the transmit data of the transmitting process in which a priority has beyond an assignment value was multiplexed according to this invention,

generating of the big transfer delay time amount by loss of the communication link packet of data transmission of severe processing of real-time constraint can be prevented.

[0086] According to this invention, since the transmit data of the transmitting process that a priority is lower than an assignment value is not concerned with conditions but it was made not to multiplex it, to data transmission of processing without the need for real-time constraint, the same actuation as the former is performed and the load of a channel is not raised.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The block diagram showing the configuration of the data source concerning the gestalt 1 of operation.

[Drawing 2] Drawing showing the network configuration containing the data source concerning the gestalt 1 of operation.

[Drawing 3] The block diagram showing the configuration of the data source concerning the gestalt 1 of operation.

[Drawing 4] Flow chart drawing showing the procedure of transmitting processing of the data source concerning the gestalt 1 of operation.

[Drawing 5] Flow chart drawing showing the procedure of multiplexing decision processing of the data source concerning the gestalt 1 of operation.

[Drawing 6] Flow chart drawing showing the procedure of packet duplicate processing of the data source concerning the gestalt 1 of operation.

[Drawing 7] Flow chart drawing showing the procedure of multiplexing packet transmitting processing of the data source concerning the gestalt 1 of operation.

[Drawing 8] The block diagram showing the configuration of the data source concerning the gestalt 2 of operation.

[Drawing 9] Flow chart drawing showing the procedure of transmitting processing of the data source concerning the gestalt 2 of operation.

[Drawing 10] Flow chart drawing showing the procedure of multiplexing packet registration processing of the data source concerning the gestalt 2 of operation.

[Drawing 11] Flow chart drawing showing the procedure of multiplex transmitting processing of the data source concerning the gestalt 2 of operation.

[Drawing 12] The block diagram showing timer processing of the data source concerning the gestalt 3 of operation.

[Drawing 13] The block diagram showing the multiplexing packet sending-out section of the data source concerning the gestalt 3 of operation.

[Drawing 14] Flow chart drawing showing the procedure of periodic processing of the data source concerning the gestalt 3 of operation.

[Drawing 15] Flow chart drawing showing the procedure of packet duplicate processing of the data source concerning the gestalt 3 of operation.

[Drawing 16] The block diagram showing the LAN driver of the data source concerning the gestalt 4 of operation.

[Drawing 17] Flow chart drawing showing the procedure of multiplex transmitting processing of the data source concerning the gestalt 4 of operation.

[Drawing 18] The block diagram showing the LAN driver of the data source concerning the gestalt 5 of operation.

[Drawing 19] Flow chart drawing showing the procedure of multiplex [with transmitting delay] transmitting processing of the data source concerning the gestalt 5 of operation.

[Drawing 20] The block diagram showing the multiplexing decision section of the data source concerning the gestalt 6 of operation.

[Drawing 21] Flow chart drawing showing the procedure of multiplexing decision processing of the data source concerning the gestalt 6 of operation.

[Drawing 22] The block diagram showing the multiplexing decision section of the data source concerning the gestalt 7 of operation.

[Drawing 23] Flow chart drawing showing the procedure of multiplexing decision processing of the data source concerning the gestalt 7 of operation.

[Drawing 24] The block diagram showing the multiplexing decision section of the

data source concerning the gestalt 8 of operation.

[Drawing 25] Flow chart drawing showing the procedure of multiplexing decision processing of the data source concerning the gestalt 8 of operation.

[Drawing 26] Drawing showing actuation of the conventional communication link mode of processing.

[Drawing 27] The block diagram showing the configuration of the conventional information processor.

[Drawing 28] Drawing showing the network configuration containing the conventional information processor.

[Drawing 29] Drawing showing actuation of the conventional information processor at the time of communication link packet loss.

[Drawing 30] Drawing showing actuation of the conventional information processor at the time of Ack packet loss.

[Description of Notations]

1 Data Source, 2 Data Sink, 10 Communications Protocol Processing Section, 12 A packet multiplexing control section, 13 A LAN driver, 100 Timer processing, 101 A timer, 102 Periodic processing, 103 Send sequence number, 104 The send sequence number received [Ack], 105 Transmitting window size, 106 A

received sequence number, 107 Receiving window size, 110 Transmitted data, 112 The waiting data for transmission, 113 Received data, 114 A ready-for-receiving ability field, 115 The retry count Records Department, 116 Retry count reference-value Records Department, 117 A retry count comparator, 120 The number Records Department of multiplexing, 121 Multiplexing decision section, 122 The multiplexing packet sending-out section, 123 Send-sequence-number Records Department, 124 Multiplexing decision processing, 125 packet duplicate processing, 126 Multiplexing packet transmitting processing, 127 The multiplexing packet registration section, 128 Multiplexing packet registration processing, 129 The data size reference-value Records Department and 131 Multiplexing demand flag, 132 The multiplex transmitting processing section, 133 The transmitting spacing setting-out section and 134 Transmitting time delay, 140 Transmit data, 160 Transmit data, 701 A processing priority, 702 The priority reference-value Records Department, 703 A priority reference value, 710 process information, 711 A process priority, 802 Multiplexing minimum priority reference value.